

Robin Price
Air of the Anthropocene



The artist Robin Price has been working with the environmental atmospheric scientist Francis Pope on creating images that show air pollution that would otherwise be invisible. Source editor John Duncan talks to them both about how the project was developed.



The artist Robin Price with digital light painter.

John Duncan: *Francis, can you tell me about your own research and how it relates to Robin's work?*

Francis: I am interested in aerosol particles which are the small particles found in the air, typically less than ten microns in size. To give you some scale, human hair is about seventy microns in diameter. So these are small particles floating around in the air. They are everywhere, even in the most pristine environments but are also produced by pollution emissions, things like cars and industry and dust resuspension and they are harmful for health. Most of my work in one way or the other revolves around aerosol particles.

What was your role in the development of this project?

Francis: We were looking at these low cost sensors and Robin got introduced to me and said he was interested in doing sensory work. It aligned very nicely; whilst air pollution is one of the major environmental risk factors in ill health, most people feel there is nothing that can be done. So actually being able to visualise it, in these light paintings, rather than just having a graph, or a table is a really effective way of engaging people.

Robin, how did you move from studying theoretical physics to having an artistic practice?

Robin: Before, I was doing visuals in nightclubs, I still am, and making music. And I've also had an interest in electronics that ran tandem to the science. I was going to do a PhD in theoretical physics but when I came to the end of my Physics Masters I had had enough. So I went to the Sonic Arts Research Centre at Queens University in Belfast to do a PhD. After that came a broader creative practice that involved more interactive gallery installation and interactive digital art.

Do you think that you carried things from your science background into your arts practice?

Robin: Yes, in the skills that it gave me to build my own equipment. And having a framework to break problems down and thinking how you could put them back together. And it gave you confidence with technology.

How did you come into contact with each other?

Robin: I did a residency at Birmingham Open Media, BOM, which is a gallery specialising in art, science and technology crossovers. As part of the residency programme, they can partner you with an academic. I was interested in air pollution and they put out a call for academics to work with me and Francis responded.

Francis, had you worked with artists before? What drew you into the orbit of Robin?

Francis: We have a shared interest in ambient music and playing with little bits of tech. There is definitely a synergy there between the two of us.

Were there any differences or similarities in how you approached working with Robin, compared to how you would approach working with somebody else from a pure science background?

Francis: I don't think so, though the photographs are by default a snapshot in time, whereas for scientific papers and presentations we would need a longer timeset to have a more robust view of the statistics. Not to say that Robin's aren't robust but we would tend to have a greater data density.

Robin, you worked with sound before, was there a reason why you moved to a visual representation of the data involving photography?

Robin: The opportunity came to go to Delhi to take part in a conference. Until then the project had been to try recording sounds from different places **and** also recording the pollution sensor levels but I wasn't massively in love with it and I couldn't see how it was going to fit together. At the same time,

Francis found they had a spare sensor. I had been trying to build my own low cost sensors or modify very cheap **ten pound** sensors. I thought I could start getting decent readings with this spare sensor.

I was also doing a project with Down Community Arts and I built this digital light painter and I had it on the desk the same day as Francis's sensor came in the post. The two things were just sat next to each other and I thought, 'you could plug *that* into *that* and do something visual rather than trying to make it around sound...'. Then I thought, in Dehli, if it is photography based you will have something that you can show *there and then*. I felt like I needed to show the scientists there what I was working with more quickly.

How is this type of data normally visualised?

Francis: In a scientific paper it would be graphs and tables. So time series graphs and then averages. Typically for air pollution we worry about the twenty-four hour average and the yearly average. Then, if we want to start thinking about where the actual pollution is coming from, going to shorter time averages is useful; so, if you look within the daily cycle you'll typically see peaks with rush hour. That's clear evidence that there's emissions from cars for example.

Robin, can you tell me about the equipment that you are using, what is the 'light stick' that we see in the photographs?

Robin: It uses LED strip left over from another work which was a light-up ping pong table. The visual element of that was rows of programmable LED strips. You can address each LED individually with a micro controller. The closer the LEDs are together the more resolution you can get in the drawing or whatever you like. The LED's come on a roll of tape.

I had done community art light paintings with the first light stick and I tried building the sensor around that but as soon as I moved



too far away from the camera it appeared too small in the image so I knew I needed to make it bigger. I had seen another project using a light painter to visualise wifi signal strength and I had also looked at Steve Mann's work around early digital light painting. They were quite big, two or three metre poles.

I didn't really have any budget so it was all sort of bits and bobs that I had lying around. I had the sensor from Francis, a micro controller and a raspberry pi computer to read the sensor and turn it into instructions for the LEDs. The whole thing was powered on a battery pack for recharging your phone.

I built a prototype, wasn't very happy, built the second one, was happier and then I worked on how I was going to visualise the data with that.

Talk us through how do you actually make one of the images.

Robin: It is a long exposure, so it only works in low light levels: dawn or dusk or at night time.

The light painter is a telescopic boompole for a film set microphone. It all has to pack away for taking on the plane. The LED strip attaches onto that with velcro pads. The sensor is hot glued and gaffer taped along with the micro controller onto a pack that was meant for when you go out running with your mobile phone. That goes on my arm.

Then I turn everything on. I take some readings so I can note down what the pollution level is. I take a series of readings either before or after the photo so I know what the pollution was. I use that in the titles.

Once I have got everything framed up, and I have set my exposure times, I ask the environmental scientist or driver, whoever I have been able to cadge into giving me a hand, to press the shutter release. Then I will start walking slowly with the light stick across the 'landscape' in front of the camera and I press a button and it starts the LEDs fading in. They are flickering off and on very quickly, the probability of any one of them

The artist on Mumbles Hill, Wales with a malfunctioning light painter.



The wearable microcontroller, trigger and particulate sensor assembly.

What do the picture captions mean?

Each picture is captioned with a reading of the amount of PM2.5 particles at the time the image was made measured in micrograms per cubic metre. PM2.5 stands for particulate matter smaller than 2.5 microns in width which is the size that are hazardous to human health.

The 2012 United States Environment Protection Agency air quality index is a widely used scale that gives a standard for PM2.5 pollution.

	micrograms/m ³ 24-hour mean	Health Implications
Good	0 - 12	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	12.1 - 35.4	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	35.5 - 55.4	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	55.5 - 150.4	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects
Very Unhealthy	150.5 - 250.4	Health warnings of emergency conditions. The entire population is more likely to be affected.
Hazardous	250.5 - 350.4	Health alert: everyone may experience more serious health effects.
Very Hazardous	350.5 - 500	

flashing on is controlled by the level of pollution. So the more pollution there is the more they will flicker on, and the more dots that will appear in the final image. It's as if the air was put under a microscope and lit up so that you could see the pollution particles, that's the idea.

A landscape photographer might be concerned with the more formal aspects of the picture making. How do you balance picture making with the scientific aspect of the work?

Robin: I would try and find backdrops that were dark enough, or were flat enough colourwise, that you could see the dots rather than being distracted by what was behind it, they were the ones that I was happier with generally.

Francis, when you look at the images, how do you think about them?

Francis: The scientific side of my brain is comparing the density of dots with the apparent visibility of pollution there. On the

artistic side it's getting a sense of the place, does it look like a dusty polluted place?

The Mexico ones were very clean which was bit of a surprise for me but I think not unfounded. In the Dehli ones, which is kind of the poster child of air pollution at the moment, you have this great density of dots whereas the other countries it is significantly less...

Robin, you worked in a number of different countries, how did that come about?

Robin: The first opportunity came because there was a conference for early career researchers in Dehli. I am not an early career researcher in environmental science, but having a PhD helped, and having Francis co-sign the application noting, this is coming out of a residency and a project about environmental issues.

I learned a lot in Dehli because I attended the conference for three days before starting the photography. Half of your brain was trying to listen for where would be good places to go in the city and the other half was

trying to fill in your general knowledge of the subject area.

I then went to Port Talbot in Wales where my initial interest in doing a project around air pollution had started. It came out of a conversation with the editor at the newspaper there who was getting all these whistleblowers coming to her saying 'the Tata steel air pollution levels had been massaged down' so she wanted to do some kind of citizen science project around taking air pollution data and then making it more accessible by turning it into a public installation. And Francis had referred me to another researcher at the University of Birmingham who had done a whole PhD on air pollution in Port Talbot.

Then there were was a similar conference to Delhi in Mexico City, luckily some of the scientists organising it knew about the project by then and were able to support me attending.

Nairobi was because Francis had a trip planned to go to the United Nations Environment Assembly there. He had been doing a field monitoring campaign over the



summer in Kenya. Then, out of that, there was a chance meeting with someone from the UN who liked the project and said, ‘we are doing a project around improving awareness of air pollution and how to lower it in Uganda, would you come and do the photographs there and then show them in the space where they were taken?’

Was there cross referencing of the results from the sensor that Robin was using with equipment that you had?

Francis: Yes, initially we lent Robin one of the low cost sensors. I should emphasise that what we lent him is a good one, if you take the whole field of low cost sensors then it is kind of the wild west, there are lots of cowboys. But we have done a lot of work calibrating that instrument over the years and we lent you a research grade monitor for a while as well to help with the results.

Robin: You can access a lot of public air quality monitoring stats, so I would access the public air quality stats and then check if my meter

was correlating with theirs. It was coming out as being good data. In Mexico the air was so surprisingly clean I checked my sensor twice against the scientists’ lab equipment.

Francis, why is it a wild west, that’s a strange phrase.

Francis: I guess someone at some point is going to make a lot of money out of micro sensors, they are wonderful things when they work. Once they are good enough and people are using the right ones it is definitely going to revolutionise science. In a city like Birmingham there are only five proper monitors and that’s for an area of at least a million people.

That misses out a whole lot of the spatial variation and each of these sites maybe costs a hundred grand, probably more. Whereas, if you have suddenly got these instruments which cost hundreds of pounds then you would certainly think about having a hundred in a city and suddenly you would have much more information about how the pollution relates to individuals and their personal exposure.

But for a lot of these cheap instruments there is just no paper trail. There’s no calibration or scientific papers which do the quality checking on these things. A lot of my research is trying to calibrate these things properly. Robin is actually in one of our science papers because of the help he gave us with doing the electronics. He is not just the artist, he is also the physics undergraduate who knew the electronics better than we did. So the collaboration has been a two way street.

Did the project reveal anything that you weren’t expecting?

Francis: Yes, I think so. You have preconceived notions of what certain areas will be like with pollution. The thing with pollution is because you can’t see it, you don’t really know. You can smell it to a degree, you can taste it if it is really polluted but you don’t know what **he** pollution levels are. So it challenged my expectations in certain locations.

Pollution light paintings displayed in Central Kampala during the UN Habitat Kampala Placemaking week.



Playground at the Institute of Himalayan Biotechnology, Palampur, India
PM2.5 30-40 micrograms per cubic metre



Mehrauli district, Dehli, India
PM2.5 500-600 micrograms per cubic metre



Prince Street air quality monitoring site, Port Talbot, Wales
PM2.5 30-40 micrograms per cubic metre



Central Kampala, Uganda
PM2.5 40-50 micrograms per cubic metre



Teotihuacan, Mexico
PM2.5 0-10 micrograms per cubic metre



Chapultepec Park, Mexico City
PM2.5 10-20 micrograms per cubic metre